Community cohesion

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DOI:
10.1080/08941920.2017.1383547

Community cohesion: social and economic ties in the personal networks of fisherfolk

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Accepted by Society and Natural Resources, 21/08/17

ABSTRACT

Social ties influence access to knowledge and cooperation in natural resource management, with the sharing of certain characteristics thought to be positive for social cohesion and participatory forms of management. The personal networks of fisherfolk (boat crew, boat owners and traders/processors) of Kenya, Tanzania and Uganda bordering Lake Victoria were investigated using personal network analysis, with fisherfolk asked who they discuss their fisheries activities with. The analysis found that networks based on the same occupation were more characteristic of fish traders/processors networks than those of boat crew and boat owners and that shared ethnicity, gender and location were characteristic of boat owner and boat crew networks, though shared ethnicity may reflect the composition of the communities rather than choice. Social and economic interactions within the networks were based on provision of credit, social support and advice, forming the basis of social cohesion.

INTRODUCTION

Social ties in fishing communities have been shown to be influential in accessing information, facilitating cooperation for resource management and influencing behaviour (Crona and Bodin 2006; Ramirez-Sanchez and Pinkerton 2009; Turner, Polunin, and Stead 2014). Research has shown that social networks within fishing communities are often characterized by shared occupation, gear type and ethnicity (Barnes et al. 2016; Barnes-Mauthe et al. 2013; Cox, Wilson, and Pavlowich 2016; Crona and Bodin 2006; Maya-Jariego, Ramos, and del Corral 2016) and that this common identity forms the basis of social

cohesion necessary for successful community engagement in fisheries management (Pinkerton 1989; Pinkerton et al. 2014).

This article builds on such findings to develop a more holistic characterisation of fisherfolk personal networks, disaggregating results by the main occupational groups within the fisheries studied to provide a more nuanced understanding of the personal networks of types of fisherfolk. It then links the characteristics of personal networks to evidence on how fisherfolk benefit from their networks, interpreted as contributing to social cohesion within the communities. It does this firstly by investigating further characteristics of the personal networks of fisherfolk; in addition to occupation, ethnicity and gear type/fishing method, gender and location of the contacts are analysed. The personal networks of boat crew, boat owners and fish traders/processors are studied to compare the main occupational groups within the fisheries and generate a detailed picture of the networks of each group. To do this, personal network analysis is employed, mapping networks of individuals rather than whole networks. Secondly, the article reports on findings on how people benefit from their personal networks, informing understanding of the basis of social cohesion in fishing communities. The article therefore addresses the following research questions: how can the personal networks of fisherfolk be characterised and what do these ties mean for the basis of social cohesion?

To answer these research questions, the article draws on research undertaken on Lake Victoria, East Africa, with this lake chosen as a case study as the lake fisheries face several significant challenges. These are: perceptions of high levels of illegalities, concern about declining stocks, particularly of one commercial species, and the lack of management effectiveness (LVFO 2016). Given the status of the stocks and concern about management,

understanding of social ties and networks could inform new approaches to management as personal networks are known to influence knowledge and behaviour (Prell et al. 2010; Stevens, Frank, and Kramer 2015). In relation to Lake Victoria, it is already known that social relationships are critical for accessing employment, buying fish and facilitating the movement of fishers between landing sites in search of better fish stocks and prices (Nunan, Hara, and Onyango 2015), that there is a gendered division of labour (Pearson et al. 2013) and social networks may be centred on gear and ethnicity (Beuving 2015). This article builds on this evidence to generate detailed pictures of occupation-specific networks and evidence from across many landing sites, rather than studying one landing site in detail, as previous studies have done (for example, Beuving 2015; Etiengi, Irvine, and Kooy 2016; Pearson et al. 2013).

Data was collected from boat crew, boat owners and fish traders/processors, with these three groups chosen as they are the largest occupational groupings at the beach, or landing site, level and because this classification reflects that given in national and regional guidance on how fisherfolk should be involved in fisheries management structures (Nunan 2010). In the study, personal networks are examined in relation to who respondents discuss their fisheries work with, therefore communication patterns are taken as a proxy for social cohesion. The concept of social cohesion was not measured directly, but was used to denote a tendency of group members to develop positive membership attitudes and behaviours towards the group, facilitated through group members' interpersonal interactions which maintain group-level conditions (Friedkin 2004).

The article reviews literature on social relations and networks within fisheries to identify key themes and issues that informed the design and analysis of the research. This is followed by

sections on research location and design, methods, results, discussion and conclusion. The analysis found that networks based on the same occupation were more characteristic of fish traders/processors networks than those of boat crew and boat owners and that shared ethnicity, gender and location were characteristic of boat owner and boat crew networks, though shared ethnicity may reflect the composition of the community rather than choice. Networks were not characterized by shared gear type, though the sample was small for this variable, once crew and owners of the same boat were removed from the analysis. Social and economic interactions were based on provision of credit, social support and advice, on a range of fisheries, business and personal matters, which forms the basis of social cohesion, rather than homogeneity in terms of ethnicity or fishing methods.

SOCIAL RELATIONS AND NETWORKS IN FISHERIES COMMUNITIES

Social relations have increasingly been seen as influencing how natural resources are used and by whom, with implications for livelihoods and the condition of natural resources (Bodin et al. 2011). The importance of social relations in small-scale fishing communities can be attributed to their characteristics, as people both live and work in the same area, leading to close and constant working, trading and social relations (Acheson 1981; Jentoft 2000). As Jentoft observes (2000, 54), "fishermen are born, raised and live in local communities. They are enmeshed in cultural and social systems that give meaning to their lives and directions for their behaviour".

Mapping of social ties within fisheries settings has been undertaken through the application of social network analysis (SNA), with research showing that people are more likely to turn to, and exchange information with, people of the same occupation (fishing crew, boat owner, middlemen/trader) (Crona and Bodin 2006; Maya-Jariego, Ramos, and del Corral 2016),

using the same type of gear (Crona and Bodin 2006; Cox, Wilson, and Pavlowich 2016) and of the same ethnicity (Barnes et al. 2016; Barnes-Mauthe et al. 2013). This reflects broader literature on social ties, where personal networks of individuals are seen as being characterized by homogeneity - members are likely to share key characteristics, whether based on ethnicity, sex, age, education, occupation or behaviour patterns (McPherson, Smith-Lovin, and Cook 2001). Such homophilic networks have been seen to limit the potential for collective management of the fisheries (Crona and Bodin 2006) and influence the type of fishing methods used and consequently the content and quantity of catch and sustainability of the fisheries (Barnes et al. 2016; Cox, Wilson, and Pavlowich 2016).

As well as occupation, ethnicity and gear type being important sources of identity within fishing communities, such communities are also characterized as being male-dominated (Kleiber, Harris, and Vincent 2015), highly mobile (Njock and Westlund 2010; Wanyonyi et al. 2016) and dependent on economic as well as social ties that facilitate access to credit at times of low catches or to purchase new fishing inputs or make repairs (Crona et al. 2010). A gendered division of labour is often observed within fisheries, with men leading the harvesting and women being involved in processing and trading (Bennett 2005; Kleiber, Harris, and Vincent 2015), though this depends on the type of fishing being referred to, as women may be involved in gleaning and using basket traps, for example (Weeratunge, Snyder, and Sze, 2010). This perception of male dominance is associated with men being more likely to undertake fishing and with the inadequate recognition of women's roles within fisheries policy and management (Kleiber, Harris, and Vincent, 2015). A further characterization is the migration of fisherfolk between landing sites, sometimes across national borders, and into and out of fisheries, with such movement reflecting fluctuations in fish stocks, catch and prices (Njock and Westlund 2010; Wanyonyi et al. 2016). Responses to

fluctuations in fish stocks, catches and prices are also mediated by the provision of credit, associated with close economic and social ties between fishers and traders. Credit and fishing inputs may be provided by traders in exchange for guaranteed supplies of fish, keeping fishers tied to a particular trader and their prices over time (Crona et al. 2010; Ferrol-Schulte, Ferse, and Glaser 2014). These ties highlight the importance of credit within fishing communities, reflecting the absence of other sources of credit, fluctuations in fish catch and supply and the importance of social relations in facilitating provision of credit (Ferrol-Schulte, Ferse, and Glaser 2014). Such gendered division of labour, movement of fisherfolk and the importance of economic ties may influence the composition and implications of the personal networks of fisherfolk.

Sharing of such characteristics by members of fishing communities, or groups within them, has been seen as offering a basis for social cohesion on which natural resource management involving users can build (Pinkerton 1989; Pinkerton et al. 2014). Such social cohesion may be manifested through information sharing networks of individuals, with information sharing influencing what people know, how they behave and the condition of the natural resource (Crona and Bodin 2006; Ramirez-Sanchez and Pinkerton 2009; Turner, Polunin, and Stead 2014). Cohesion within groups suggests that there is a level of attractiveness, with sources of cohesiveness seen as being "satisfaction of interpersonal needs and satisfaction of needs related to the task" (Argyle 1969, 220). Argyle goes on to note that "interpersonal needs are satisfied when the conditions for friendship-formation are present – frequent interaction and similarity of members" (1969, 221). The basis of social cohesion, then, may depend on the source of attractiveness for being part of a group, with a dimension of similarity between members.

From this review of literature, the variables of occupation, gear type, ethnicity, gender and location of network members are seen to be important within fishing communities, both for cohesion within communities, for involvement of communities in fisheries management and for the status of the fisheries. These variables form the basis of the personal network analysis reported on here. Data on types of benefits received by fisherfolk is also generated, reflecting literature that sets out the strength of social and economic ties within fishing communities.

RESEARCH LOCATION AND DESIGN

Lake Victoria is bordered by three countries, Kenya, Tanzania and Uganda, covers an area of 68,000 km^2 and has around 1,500 landing sites, with 200,000 fishers (LVFO 2015a) and many more people involved in the fisheries, through processing, trading, transport, fishing inputs and regulation. The fisheries is characterized as being male dominated, with around 75% of people at the landing sites, where fish is landed, initially sold and sometimes processed, being male (LVFO undated) and artisanal, with locally-made boats predominantly propelled by paddles (59%), outboard engines (30%) and sails (10%) (LVFO 2015a). Three commercial species dominate the fisheries: Nile perch, Nile tilapia and the sardine-like dagaa. Each serves different markets, with most of the Nile perch processed by factories before being exported, mainly to Europe, Nile tilapia serving domestic markets and dagaa used locally, nationally and exported regionally. The different target species are also associated with different gear types and fishing methods, with gillnets targeting Nile perch and Nile tilapia, hooks targeting Nile perch and small seine nets targeting dagaa. Around 54% of fishers target Nile perch, 29% target dagaa and 13% tilapia (LVFO 2015a).

The Nile perch and tilapia fishing sectors are widely believed to be characterized by high levels of illegalities, referring to the use of using undersized gillnets and hooks and illegal

gears, particularly monofilament nets and beach seines, all with the intention of catching smaller than permitted fish (Kariuki 2012). This high level of illegalities is linked to concern that the stocks of Nile perch have substantially declined since at least the early 2000s, with a similar decline in the size of fish caught (LVFO 2015b, 2016; Mkumbo and Marshall 2014). The decline in fish catches, stocks and size of Nile perch is seen as both resulting from and leading to the use of illegal gears that enable smaller fish to be caught.

A case study approach was adopted as it enables the data to be contextualised, thus generating a rich, in-depth picture of the situation (Yin 2014). A mixed-methods approach was used for the data collection and analysis, with a quantitative questionnaire used to generate mainly quantitative data for the personal network analysis and a qualitative interview to collect more in-depth and rich data on the experience of fisherfolk. This mixed-methods approach enabled comparative data to be generated on the composition of the personal networks on samples of fisherfolk, whilst also generating more in-depth information on perspectives and experience of social groupings within the fisheries communities.

DATA COLLECTION AND ANALYSIS

Personal networks represent the unbonded "sets of relationships that surround each of a sample of focal actors" (Hâncean, Molina, and Lubbers 2016, 137), and personal network analysis (PNA) allows for the comparison of networks across categories of respondents, thereby enabling analysis of the characteristics of actors that categories of individuals interact with, to assess the basis and extent of similarity, or homophily (McPherson, Smith-Lovin, and Cook 2001). The study therefore employed PNA and developed a questionnaire using EgoNet software (SocioWorks 2016) installed on computer tablets. The EgoNet questionnaires, one for each of the three groups of respondents, consisted of four sections:

i) Demographic background: this section collected data on the basic attributes of the respondent, including age, gender and place of residence, as well as the type of fishing gear used and the length of their residence in the location of the interview.

ii) The name generator: respondents were asked to name up to seven people with whom they had most discussed their fishing activity within the previous two weeks. The named people are referred to as 'alters'. 'Up to seven' was chosen to balance the need to generate a detailed picture of personal networks and the time taken to undertake interviews.

iii) The name interpreter: respondents were asked questions to collect the same demographic data as in the first section, as well as to define the nature of ego's relationship with the alter (friendship, business or kinship, for example) and to name up to three benefits that each receive from the relationship.

iv) The name inter-relater: respondents were asked about the relations between their alters. This data is not reported on here due to the focus of the paper.

In-depth interviews were carried out with a topic guide, though are not significantly drawn on in this paper as the results are largely taken from the PNA. The design of the EgoNet questionnaire and qualitative interview guide were informed by literature on fisheries co-management, compliance with fisheries regulations, social relations in fisheries communities and PNA studies and the draft questionnaires and interview guides were pre-tested in pilot interviews to test for clarity, the type of data generated and the duration of interviews to inform logistics planning. The average length of the interviews was 60 minutes. The interviews were recorded and then transcribed and translated to English by the interviewers.

The fieldwork was carried out in all three riparian countries, Kenya, Tanzania and Uganda, with data collected at a sample of 18 landing sites (six in each country). The landing sites were chosen to reflect the diversity of Lake Victoria fisheries communities in terms of geographical diversity, island and mainland landing sites, a range of population size/boat numbers and sites targeting different commercial species, including mixed-species sites. Data collection was undertaken between April to June 2015 by researchers from the national fisheries research institutes. At each landing site a sample of up to 6 fisheries' stakeholders were interviewed from the three main occupational groups. In total, 36 boat crews, 36 boat owners and 32 traders and processors were interviewed. Respondents were randomly approached based on availability at the beach and through local leaders asking people to be interviewed on behalf of the research team. This may have introduced bias into the samples, based on proximity to the beach and respondents known to the local leaders. The effect of these factors is unknown, but by comparing data across the landing sites and triangulating between interviews undertaken with different stakeholder groups, the data has been interpreted with care and rigour.

Verbal consent was sought for the participation in interviews, after the interviewer had explained the nature, consequences and potential risks of the research, and once the interviewers were confident that the respondent had understood the relevant information. Confidentiality and anonymity was ensured through assigning unique alphanumeric codes for each respondent, with no recording of names.

The personal network data was first exported from EgoNet to Excel spreadsheets, one for each of the three groups of respondents and then imported to R, a program for statistical computing, for further analysis using the egonetR package for PNA, developed by Krenz and

Herz (2016). The analysis of the degree of homophily involves calculating the proportion of ties in an ego network that are homophilus – i.e. they are the same in relation to a specific characteristic (Prell 2012). The analysis used the approach developed by Krackhardt and Stern (1988) to analyse groups within social networks in terms of whether the ties occur within a group or are external to a group. The analysis involves subtracting the number of ties to members within the same group from the number of ties to members of other groups, and dividing that number by the total number of ties. The resulting E-I (external-internal) index ranges from -1 where all ties are internal to the group to +1 where all ties are external to the group. This analysis was conducted in relation to four areas: gender, ethnicity, fishing methods and occupation. Location/residency was examined through relational terms ('x lives in the same village/same region as me') and so it was not possible to assess for homophily in the same way as for gender or fishing methods, for example, where R was used to calculate the percentage of alters who shared identical properties with egos (i.e. males and males, gillnet fishers and gillnet fishers).

The sample included 85 males and 19 female respondents, with most women being in the fish traders and processors category; the gender imbalance is a consequence of the occupation-based sampling, with the majority of boat crew and boat owners being men (LVFO undated). The respondents ranged from 19 to 66 years of age, with the mean value of 40 years. On average the respondents reported 11 years of experience working in their profession. Most of the respondents lived at the landing site where they were interviewed, with the exception of 15 respondents.

RESULTS

The characteristics of the personal networks of fisherfolk are presented here according to gender, ethnicity, fishing methods, occupation and location. The results are summarized in two tables: Table 1 sets out the E-I indices for each variable and Table 2 provides a textual summary of the characteristics of the personal networks of each occupational group.

Table 1 E-I indices

Factor	Boat crew	Boat owners	Fish traders/ processors
Gender	-0.83	-0.71	-0.50
Ethnicity	-0.38	-0.47	-0.18
Fishing methods:			
Propulsion	0.60	0.75	n/a
Gear type	0.32	0.33	n/a
Target species	0.31	-0.11	n/a
Occupation	0.18	0.23	-0.25

Table 2 Summary of the characteristics of the personal networks of each occupational group

Variable	Boat crew networks	Boat owner networks	Fish trader/processor networks
Occupation	Most likely to be other boat crew though boat owners also form an important part of their network, especially those they are employed by	Most likely to interact with other boat owners, then crew and then fish traders/processors	Most likely to interact with other fish traders/processors, then boat owners, with few crew in their networks
Gender	Information networks are mainly male	Information networks are mainly male	Information networks are likely to be of both genders
Fishing methods and target species	Usually mixed networks in terms of fishing gears, target species and means of propulsion	Usually mixed networks in terms of fishing gears, target species and means of propulsion	Usually mixed networks in terms of working with different species

Ethnicity	Some evidence of networks of the same ethnicity but not exclusive	Some evidence of networks of the same ethnicity but not exclusive	Likely to be more ethnically diverse than boat crew or owners networks
Location	Likely to reside at the same landing site	Likely to reside at the same landing site	Around half of their networks reside at the same landing site, but many do not reside at a landing site

Gender

The networks showed a strong degree of homophily with regard to gender, which is unsurprising given that the sample was predominantly male and there are proportionately more men than women at the landing sites. More than 60% of the respondents listed only alters of the same gender, with the mean degree of homophily for the whole sample being -0.69. The degree of homophily is especially high among the boat crew respondents, with 77% of respondents (all of the respondents were male) reporting only male alters, while only two respondents reported sharing information with more female than male alters. The occupation of the 17 female alters were given as fish traders, fish processors and boat owners, with eight female alters not working in the fisheries sector but deriving their livelihood from agriculture; these could have included respondents' relatives.

Ethnicity

Ethnicity was self-reported, with responses subsequently clustered and coded. 45 ethnic groups were cited which were categorised into 12 main ethnic identities; Luo and Baganda ethnicities were the largest groups among the social ties. The E-I index for the whole sample was -0.31, with more than one third of the sample having networks consisting only of people of the same ethnic background, indicating a moderate degree of ethnic homophily. This does not imply, however, that the respondents necessarily intentionally choose to interact with

people of the same ethnicity, as the homophily may simply be a result of the potential pool of alters. The degree of homophily of fish trader/processor networks was less than for boat crew and boat owners, which may be explained by the interaction that traders and processors have with people beyond the confines of immediate localities.

Fishing methods

47% of the boat owners and crew respondents use paddles on their boats, 12% used sails and 40% of respondents reported that they use an engine, the most advanced mean of propulsion, which allows them to fish in the open parts of the lake. For the large part, the alters either worked in the same boats as egos (where egos were boat crew) and in the boats owned by egos (where egos were boat owners), or were the owners of the boats in which egos worked. This included 56% of all boat crew alters and 23% of all boat owner alters. Once these two categories were excluded, the level of homophily was found to be low. More than two thirds of respondents listed only people who use different propulsion, either sails or engine, and only 5% listed any alters who used the same propulsion.

The structure of alters regarding the type of fish they target show a similar picture. More than two thirds of respondents either targeted Nile Perch or processed and traded Nile Perch, while tilapia and dagaa were targeted, traded or processed by 10% and 21% of the respondents, respectively. When not including alters who by necessity share the same target species with respondents, the E-I index has a positive value of 0.36, with 44% of respondents listing people who only deal with different types of fisheries.

With regard to fishing gear, half of the respondents used gill nets and the rest used long lines and dagaa nets. There was slightly more homophily in relation to gear type than in relation to

the type of propulsion and target fish species, but here too after excluding alters who work on the same boats as respondents, there seemed to be little tendency to form information sharing groups based on the type of fishing gear. 11% of respondents listed only people who use the same fishing gear. However, in response to the interview questions on social groupings, some responses suggested that there are groupings based on target species, gear type or fishing method, saying that: "Yes, in our landing site, there are two major groups. Nile perch fishers and dagaa fishers. Fishers interact much based on their fishing activity" (boat owner) and "yes, it is obvious they group themselves according to the gear types and techniques such as boat owners, crews, fish traders, long lines, and beach seine and gillnets respectively" (boat crew). However, others felt that social groupings were based more on occupation, with one stating that "somehow you can identify them, based on nature of activities, boat owners, crews, fish traders, but all people interact very well at the beach" (boat owner) and others suggesting that there are no obvious groupings: "it is not possible to identify groups here because people interact very well in many aspects" (boat crew).

Occupation

The E-I index shown in Table 1 for each occupation reflects a diversity of membership. The E-I index for boat crew and boat owners is positive, more so for owners than crew, reflecting the greater heterogeneity of boat owner networks. The greater degree of homophily in fish trader/processor networks reflects the strong interdependence within this group, with trade between fish traders along the value chain creating interdependence, as well as assisting each other in their work.

Location

More than 80% of the respondents lived at the landing sites where they were interviewed. This was also the case for their alters; the information-sharing networks were therefore predominantly locally embedded, with 64% of the alters living at the landing site where the interview was carried out. However, when broken down by occupation, the data confirms that the personal networks of fish traders and processors have the widest reach. In comparison to boat crew and boat owners, whose alters resided in the same location for 75% and 68% of the cases respectively, only 55% of the alters listed by fish traders and processor lived in the same location. Furthermore, the latter group also had the highest degree of alters who lived in urban areas (not at a landing site); almost 40% in comparison to 18% and 30% for boat crew and boat owners.

How do fisherfolk benefit from ties?

Respondents were asked to name up to three benefits they receive from their relationship with their alters and up to three benefits alters receive from them. The benefits were not ranked and not all gave three. Boat crew cited financial help (32% of the responses relating to crew alters and 30% to boat owners) and provision of advice (45% of responses for both crew and boat owner alters) as the most common types of benefits, with most advice relating to fishing grounds, but also included advice on running businesses and getting into fisheries. Social support from crew to crew includes support whilst working together, replacing each other when one cannot go out to fish and giving fish when one has not been out to fish. 19% of responses relating to boat owner alters referred to receiving employment. Boat crew alters received similar benefits, though with fewer cases of financial help going to boat owners (21% of responses) and advice (35%). Instead, boat owners benefit from receiving fish from the crew, as do fish traders.

Most boat owners who named boat crew as their contacts reported the main benefit they receive from them as being their employment, with appreciation of the skills and knowledge of boat crew reported. Crew in turn receive employment and hence income from their relationship with boat owners. Financial assistance (credit) and advice were the two main categories of benefit received by boat owners from each other, being 35% and 40% of the responses, with other benefits cited as including assistance with business when away, supply of bait and net and boat repairs. Boat owners stated that they benefit from access to credit and their fish being bought by fish traders and their named fish trader contacts receive fish from them as the main benefit.

Provision of credit, and access to credit, is the most often cited benefit from fish traders/processors, with a third of benefits to boat owners and to other traders/processors being financial assistance. Fellow fish traders/processors also benefit significantly from receiving advice and assistance, though the buying and selling of fish is also a highly cited benefit within these personal networks. This is nuanced with examples of traders buying on behalf of others, receiving benefits in the form of access to ice, traders giving and receiving benefits in the form of helping each other trade and helping each other when one is unwell. Further benefits include the reliability of access to markets and income.

The personal networks are therefore critical for facilitating access to credit, linked to employment, provision of gears, supply of fish and access to markets. Sharing of information and provision of advice, on a range of fisheries, business and personal matters, are also important functions of the personal networks, as is social support, particularly if someone has a problem and is unable to work. The networks facilitate the flow of fish, income, employment and information at the fish landing sites and therefore reflect the characteristics

of the personal networks, with strong dependence between crew, between crew and boat owners, between boat owners and fish traders/processors, and between fish traders/processors.

DISCUSSION

The personal networks of the three occupational groups provided some confirmation of findings elsewhere, but also brought out new perspectives. Interaction with people of the same occupation was found to be important for all three occupational groups, though more so for fish traders/processors than boat crew and boat owners, which was surprising. This may reflect the close working and social relations between crew and owners and the social and economic ties between fishers and traders/processors, where provision of credit is associated with fish supply, as found by Crona et al. (2010) and Ferrol-Schulte, Ferse, and Glaser (2014) on the coast in East Africa. The personal networks of fish traders/processors might have been expected to be more diverse in terms of occupation, given their interaction with crew, boat owners and other traders/processors. However, instead their networks were found to be fairly homophilic in terms of occupation, reflecting the high degree of dependence on each other for access to fish to trade onwards, access to credit and business advice.

The E-I scores for propulsion, target species and fishing gear suggest that there is not a high degree of homophily according to fishing methods and gears, which contrasts with findings elsewhere that the social networks of fishers tend to be strongly based on similar types of gears and fishing methods (Crona and Bodin 2006; Cox, Wilson, and Pavlowich 2016). However, it is acknowledged that the sample sizes were low once alters of the same boat had been taken out of the sample and the qualitative responses show mixed evidence of perceptions of social groupings, with some support for Beuving's (2015) observation of quite

distinct groups based on gear-type at two landing sites in Uganda. The findings suggest then that gear type and fishing methods used do not dominate as a shared characteristic of personal networks but do have relevance in some places.

The relatively high level of homophily based on gender, particularly for boat crew and boat owners, supports the impression of fisheries as being male-dominated, as given in much of the literature on gender and fisheries (Bennett 2005; Kleiber, Harris, and Vincent 2015), with a gendered division of labour reflected in the personal networks. A fairly high level of homophily was found in terms of ethnicity, in line with findings in other fisheries (Barnes et al. 2016; Barnes- Mauthe et al. 2013), though it would not be appropriate to draw too many conclusions from this as this similarity may be 'induced', due to the prevalence of people from the same ethnic background at a landing site, rather than a result of choice. This leads onto the final reflection on the characteristics of the personal networks. The personal networks of boat crew and boat owners are more likely to reside at the same beach, whereas around half of network members of fish traders/processors do not. The high degree of mobility of fishers might suggest more geographically diverse networks, but this finding supports the observation that social networks facilitate movement and that boat crew may move together or with their boat owner, though boat owners are less likely to move than crew (Nunan 2010). The more geographically diverse nature of fish trader/processor networks reflects their trading networks beyond the landing site.

The personal networks of fisherfolk reflect their interdependence and the ties facilitate the flow of money (income, employment and credit), fish and advice. Constant interaction within and between social groupings is inevitable given that most respondents live and work at the landing sites, as is the case in many other small-scale fisheries (Acheson 1981; Jentoft 2000).

Whilst there is clearly a degree of homophily within personal networks, there is also evidence of interaction across groups, however defined.

Networks characterized by homophily have not always been viewed favourably in management terms. Crona and Bodin (2006), for example, found in a Kenyan coastal setting that strong homophily within groups that have different knowledge to each other about local ecological conditions may account for the lack of collective action. On Lake Victoria in Kenya, Etiengi, Irvine, and Kooy (2016) argue that kinship ties within the fisheries communities mean that people are reluctant to fully participate in enforcement of fisheries regulations and facilitate the continuation of illegal fisheries practices. There may be some support for this from this research, given the high level of ethnicity homophily.

CONCLUSION

This paper addressed the following research questions: how can the personal networks of fisherfolk be characterised and what do these ties mean for the basis of social cohesion? It was found that the personal networks of boat crew and boat owners were more mixed in terms of occupation than might have been expected, reflecting a higher degree of interaction between these groups and with fish traders/processors and other actors at landing sites than suggested by previous research on social networks in fishing communities. In contrast, the networks of fish traders/processors were more strongly based on the same occupation. The high degree of similarity on the basis of ethnicity and gender conforms with existing literature, though the dominance of network members residing at the same landing site suggests that whilst mobility may widen networks, people still largely rely on people in close proximity to them and may well move with people in their close networks.

The composition of the networks is strongly linked to the provision of credit, social support and advice, on a range of fisheries, business and personal matters, suggesting that credit and advice, or information exchange, form the basis of social cohesion. The importance of such ties and the resultant social cohesion reflects the integration of the work and home locations and networks, characteristic of small-scale fisheries in developing countries. Pinkerton (1989) and Pinkerton et al. (2014), suggest that social cohesion based on kinship, ethnicity or using the same gear is necessary for communities to collectively manage fisheries, however social cohesion associated with social and economic interactions based on provision of credit, social support and advice is important within fishing communities and thus should be considered in working with fishing communities in both development interventions and designing collaborative management approaches. It may not only be kinship ties (Etiengi, Irvine, and Kooy 2016), for example, that result in lack of enforcement and fishing illegalities, but social and economic ties associated with credit and advice, reflecting findings on literature on patron-client relations in fisheries, where the 'patron', often a trader, influences the type of gear and methods used and hence the sustainability of the fisheries (Miñarro et al. 2016).

This suggests that efforts to address the challenges facing Lake Victoria of high levels of illegalities, declining stocks and limited effectiveness of fisheries management should learn from the close economic and social ties within the communities. Such ties suggest that communication encouraged via peers, credit-providers encouraged to support legal rather than illegal fishing and representatives of all occupational groups included in fisheries management could assist in responding to these challenges by building on the existing basis of social cohesion.

These conclusions should be interpreted within the context of a relatively small sample of alters per ego, though seven is in the range of many personal network studies, with between five to ten alters sought (McCarty 2002). A larger number of alters would, however, provide a more representative sample of personal networks (McCarty 2002). Generating data on a larger number of alters would have been unwelcome by the respondents in this study, given the additional time required and the repetitive nature of the exercise. However, larger sample sizes, both in terms of the number of egos and alters, could be sought within research building on the study reported on here, together with analysis of multiple bases of homophily, referred to as 'multiplexity' by McPherson, Smith-Lovin, and Cook (2001). Larger sample sizes and analysis of potentially multiple and cumulative forms of homophily would enable the effect of fishing technique, for example, to be investigated more robustly than was possible in this study.

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